UCRL-JC-123809 Abs

MANYBEAM VELOCIMETER FOR FAST SURFACES

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For oral presentation
at the 22nd International Congress on High-Speed Photograph and Photonics
to be held in Santa Fe, New Mexico, Oct 27-Nov 1, 1996.

ABSTRACT

For the past 5 years, we have conceived, built and successfully used a new 10 beam laser velocimeter for monitoring the velocity vs time histories of fast moving surfaces. We are expanding the capability to 20 beams. Several new innovations have allowed us to increase our diagnostic capability from the 2 beams we have had in the past to 10 now and 20 in the near future. We now use a pulsed 532 nm laser rather than DC Argon lasers, and do all our transport via optical fibers. We have conceived and used a new method of filling several optical fibers efficiently from a laser beam with a radius x divergence product exceeding that of the fibers being filled. We developed a new type of optical probe for efficient light collection. Also new is our third version double cavity fixed etalon interferometer, which is cheaper and better and more flexible than our previous two versions. However, the most important innovation making the system practical is the one of multiplexing 5 to 10 beams through a single Fabry-Perot interferometer (which can also be striped and double cavity) without losing any light that otherwise could have been accepted by the equivalently-performing single beam velocimeter. Multiplexing five to one reduces the cost of a 20 beam system by that of 16 interferometers and makes operation easier and the system more compact than without mulitplexing. We have also tested a scheme for using 5 beams and 10 recorders so each beam has both a fast and a slow recorder, without reducing the light available to the fast cameras relative to a 5 beam, 5 recorder configuration. We can also have 10 beams with 10 recorders, each running in the dual sweep-rate mode, where the sweep rate is programmed to change once anytime in course of a single streak. In addition, at least 5 of the 20 recorder system will use a different type of streak camera we developed, consisting of a triggered galvanometer mirror which sweeps the fringe pattern across a stationary CCD camera.

6. Key words: velocimetry, multiplexing, Doppler-shift

7. D. Goosman is the leader of a group dealing with velocimetric, radiographic, optical, and holographic instrumentation, who has been involved part-time for 20 years at LLNL in VISAR and Fabry based velocimetry systems. His previous employment was as a nuclear physicist at Brookhaven.

*This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.